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## FOOD HABITS OF THE CINEREOUS HARRIER (*CIRCUS CINEREUS*) IN THE ARAUCANÍA, SOUTHERN CHILE

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The Cinereous Harrier (*Circus cinereus*) is widespread in South America, ranging from northern Colombia to Tierra del Fuego in open areas such as marshes, grasslands, shrublands, and steppes (Jiménez and Jaksic 1988, and references therein). In Chile, it is a resident along its entire distributional range from Copiapó (30°S) to Tierra del Fuego (57°S) (Hellmayr 1932, Johnson 1965). Its status varies from “rare” in northern Chile, to “frequent” in central and southern Chile, to “abundant” in southernmost Chile (Jaksic and Jiménez 1986). Although historical forest cutting and establishment of croplands has favorably affected the Cinereous Harrier in southern Chile, current increases of exotic pine and eucalyptus plantations and marsh draining for urban and agricultural development appear to negatively impact harriers by decreasing their hunting habitat, prey availability and nest sites (Jaksic and Jiménez 1986).

Little is known about the biology of this South American harrier, except for studies conducted by Jiménez and Jaksic (1988) in Chile and by Saggese and De Lucca (1995) in Argentina. Data on its diet in the Magellanic steppe were reported by Jiménez and Jaksic (1988) and

reanalyzed by Iriarte et al. (1990). Here, we report the first quantitative data on food habits of the Cinereous Harrier in an agricultural landscape of the Araucanía region (ca. 38°S) in southern Chile.

### STUDY AREA AND METHODS

We studied two pairs of Cinereous Harriers in a 200-ha area at Tricauco Farm, located approximately 6 km south of Traiguén city (38°14'S, 72°38'W) in the Araucanía Region of Chile. The landscape comprised croplands of wheat and corn, grasslands, marshlands, exotic tree plantations of *Pinus* spp. and *Eucalyptus* spp. and remnants of the original deciduous *Nothofagus* forest. The climate is moist-temperate with a Mediterranean influence (di Castri and Hajek 1976) and mean annual rainfall and temperature are 1400 mm and 12°C, respectively. Although originally the Araucanía region extended from Maule Province to Seno Reloncaví, the current Administrative Araucanía Region extends from the Renaico River (37°30'S) to Calafquén Lake (38°47'S).

During August 1996 (austral winter), we collected 68 pellets in abandoned pastures and marshes where harriers hunted and perched. Pellets were collected both from open ground in pasture-marshes and under trees, fences and stumps used as perches by harriers. Avian prey were identified mainly on the basis of feathers, using two com-

Table 1. Food habits of Cinereous Harriers (*Circus cinereus*) in an agricultural landscape of the Araucanía, southern Chile.

PREY	MASS (g)	FREQUENCY (%)	BIOMASS (%)
Mammals		21.4	26.3
Rodentia			
<i>Abrothrix olivaceus</i>	23	4.4	0.9
<i>Oligoryzomys longicaudatus</i>	26	2.7	0.6
<i>Mus musculus</i>	21	0.9	0.2
Unidentified rodents	23	10.7	2.2
Lagomorpha			
<i>Oryctolagus cuniculus</i> <sup>a,b</sup>	800	0.9	6.4
<i>Lepus europaeus</i> <sup>a,b</sup>	1000	1.8	16.0
Birds		67.0	73.3
Tinamiformes			
<i>Nothoprocta perdicaria</i>	160	2.7	3.8
Ciconiiformes			
<i>Nycticorax nycticorax</i> <sup>a</sup>	600	0.9	4.8
Anseriformes			
<i>Anas flavirostris</i>	400	0.9	3.2
<i>Anas georgica</i>	700	1.8	11.2
Falconiformes			
<i>Milvago chimango</i> <sup>b</sup>	100	0.9	0.8
Galliformes			
<i>Callipepla californica</i> <sup>b</sup>	64	2.7	1.5
Charadriiformes			
<i>Vanellus chilensis</i>	270	3.5	8.6
Columbiformes			
<i>Columba araucana</i>	300	2.7	7.2
<i>Zenaida auriculata</i>	137	9.8	12.1
Passeriformes			
<i>Troglodytes aedon</i>	10	0.9	0.1
<i>Turdus falcklandii</i>	90	14.3	11.5
<i>Sicalis luteola</i>	16	15.2	2.2
<i>Sturnella loyca</i>	96	3.5	3.0
<i>Curaeus curaeus</i>	95	0.9	0.8
<i>Phrygilus patagonicus</i>	38	0.9	0.3
<i>Carduelis barbata</i>	15	0.9	0.1
Unident. passeriformes	51	4.5	2.0
Reptiles		4.5	0.3
<i>Liolaemus</i> spp.	8	4.5	0.3
Insects		7.1	0.03
Coleoptera	0.5	3.5	0.01
Orthoptera	0.5	1.8	0.01
Unident. insects	0.5	1.8	0.01
Total prey items (N)	112		
Total biomass (g)	12 502		
Total pellets (N)	68		

<sup>a</sup> Likely juveniles.<sup>b</sup> Introduced.

plementary methods: microscopic analysis of feather structures such as nodes and barbules (Reyes 1992) and comparison of feather coloration patterns with voucher specimens deposited in the Zoology Department, Universidad Austral de Chile at Valdivia and in the National Museum of Natural History at Santiago. Because we observed harriers eating birds entirely, we used the presence of feathers of a given species in a pellet as representing only one individual. Mammals were identified and quantified on the basis of skulls or dentary pairs, whichever gave the highest count following keys in Reise (1973). Reptiles were identified and quantified by the presence of scales and/or teeth, and insects by head capsules, mandibles or elytra following keys in Donoso-Barros (1966) and Peña (1986), respectively. We identified prey items to the finest possible taxonomic category.

Biomass contribution was estimated following Marti (1987). Masses of birds and small mammals were obtained for birds using Jaksic et al. (1983), Morgado et al. (1987), Jiménez and Jaksic (1989) and Egli (1996) and for mammals using Greer (1968), Pearson (1983) and Martínez (1993). Masses of lagomorphs were obtained from juveniles found killed by raptors such as Cinereous Harriers and Short-eared Owls (*Asio flammeus*). Masses of lizards and insects were obtained from unpublished data of the authors. We assumed that masses of unidentified prey were similar to the mean mass of the most closely related identified taxon.

Although it was not possible to obtain simultaneous data on relative abundance of bird species, during the winter of 1997 we estimated bird abundance using eight parallel, fixed-band (100 m wide) line transects (Bibby et al. 1993) placed 400 m apart in the hunting areas of harriers. To test whether harriers took birds selectively or opportunistically, we compared prey frequency distribution in pellets with bird abundance using Spearman's rank correlations as recommended by Jaksic (1979) for coarse comparisons between prey consumption and availability.

#### RESULTS AND DISCUSSION

Pellets averaged  $28.2 \pm 1.9$  ( $\pm$ SE) mm in length and  $14.9 \pm 0.9$  mm in width ( $N = 50$ ) and had a mean dry weight of  $1.0 \pm 0.6$  g ( $N = 68$ ). We identified 112 prey items in these pellets including 16 species of birds, five species of mammals, one species of reptile and two orders of insects. Birds were the staple prey comprising 67% by frequency and 73% by biomass of the diet. Most birds eaten were Passeriformes (41.1%) with Grassland Yellow-Finches (*Sicalis luteola*) and Austral Thrushes (*Turdus falcklandii*) being the most frequently eaten (Table 1). Eared Doves (*Zenaida auriculata*) ranked third by frequency but, by biomass, Eared Doves and Austral Thrushes were the most important prey. This agreed with anecdotal reports by Housse (1945), who indicated that Eared Doves were the preferred prey of Cinereous Harriers in southcentral Chile. Mammals were the second most common prey with olivaceous field mice (*Abrothrix olivaceus*) and long-tailed rice rats (*Oligoryzomys longicaudatus*) the most frequent. However, because of their larger size, lagomorphs accounted for almost all of the mam-

malian biomass (22.4%). The incidence of reptiles and insects was negligible both by number and biomass.

Spearman rank correlation coefficients were  $r_s = 0.72$  ( $P < 0.01$ ) when all bird prey species were considered, and  $r_s = 0.94$  ( $P = 0.02$ ) when passerines alone were considered. These trends indicated that Cinereous Harriers hunted avian prey opportunistically rather than selectively (i.e., they took avian prey in proportion to their availability).

Overall, our results agree with those of Jiménez and Jaksic (1988), who reported that birds were the main prey of Cinereous Harriers during the breeding season in steppe marshes of Magallanes, southernmost Chile. Also, the diet of these harriers was similar to that of Long-winged Harriers (*Circus buffoni*) in Argentina (Bó et al. 1996), indicating that South American harriers are essentially bird predators.

RESUMEN.—Determinamos la dieta del vari (*Circus cinereus*) en agroecosistemas de la Región de la Araucanía, sur de Chile, analizando 68 egagrópilas colectadas en asociaciones de pastizal-humedal durante el invierno de 1996. Los varis consumieron un amplio espectro de presas que incluyó aves, mamíferos, reptiles e insectos. Sin embargo, las aves fueron la base de la dieta (16 especies presa), alcanzando 67% en frecuencia y 73% en biomasa. Entre éstas, las más frecuentes fueron *Sicalis luteola* (15%), *Turdus falcklandii* (14%) y *Zenaida auriculata* (10%). En términos de biomasa, *Z. auriculata* y *T. falcklandii* hicieron una mayor contribución a la dieta (ca. 12% cada uno). Los mamíferos alcanzaron el 21% de la frecuencia y contribuyeron con el 26% de la biomasa. La contribución de reptiles e insectos fue poco relevante. En general, nuestros resultados son coincidentes con otros autores, quienes mencionan a las aves como las principales presas de los varis en la Región de Magallanes.

[Traducción de Autores]

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